

# WHITE PAPER



USDA Forest Service

Pacific Northwest Region

Umatilla National Forest

## WHITE PAPER F14-SO-WP-SILV-22

### Range of Variation Recommendations for Insect and Disease Susceptibility<sup>1</sup>

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Initial Version: **MAY 2008**

Most Recent Revision: **FEBRUARY 2012**

## INTRODUCTION AND ASSUMPTIONS

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This white paper provides susceptibility percentages, expressed as ranges, for nine insects or diseases of Blue Mountain forests. Forest insects and diseases occupy forest vegetation as their habitat, so each set of susceptibility ratings is associated with a corresponding set of forest reference conditions. Reference conditions are expressed as percentage ranges for each of four vegetation attributes: species composition, forest structural stage, forest canopy layering, and tree (stand) density.

Reference conditions were selected to be compatible with rating factors used in this document: *Rating forest stands for insect and disease susceptibility: a simplified approach* (Schmitt and Powell 2005). Rating factors are compatible with Umatilla National Forest's composite vegetation database (Powell 2013), and with more recent databases developed by using Most Similar Neighbor or Nearest Neighbor imputation procedures (Crookston et al. 2002, Moeur and Stage 1995). Rating factors pertain to nine individual or grouped insect and disease agents (not all factors are used with every agent).

Estimated historical vegetation conditions were categorized for each of three up-land-forest potential vegetation groups (PVG): dry, moist, and cold. PVGs function

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<sup>1</sup> White papers are internal reports and receive only limited review. Viewpoints expressed here are those of the authors – they may not represent positions of USDA Forest Service.

as an effective ecological stratification unit because they reflect differences in inherent site potential and disturbance regimes. PVG information is provided as separate sections in this document.

PVG stratification is based on this report: *Potential vegetation hierarchy for the Blue Mountains section of northeastern Oregon, southeastern Washington, and west-central Idaho* (Powell et al. 2007). Appendix 1 shows how PVTs are assigned to PVGs.

Estimated reference conditions were compiled by David C. Powell from a variety of published and unpublished sources (Powell 2019). A white paper, ***Range of variation recommendations for dry, moist, and cold forests*** (Powell 2019), provides detailed information about reference conditions, and it describes the range of variation analytical technique.

When combining subcategory values for an attribute, vegetation ranges will sum to 60-130% (a central tendency for this range is app. 100%); four attributes are used to characterize reference conditions: species composition, forest structural stage, forest canopy layering, and stand density.

For each PVG, a set of initial conditions are provided for one scenario: low departure from reference conditions. Conditions associated with a low departure scenario are assumed to most closely approximate an historical range of variability for forest ecosystems, which is defined as Blue Mountains presettlement (pre-Euro-American emigration) conditions for a timeframe of approximately 1800-1850.

***Susceptibility is defined as relative probability (low, moderate, high) of insect or disease agents being present and causing disturbance.***

Percentage ranges for insect and disease susceptibility were developed by Craig L. Schmitt, and they reflect professional judgment about relative amounts of insect or disease susceptibility associated with forest reference conditions, along with information from published reports characterizing susceptibility associated with early forest conditions (Hessburg et al. 1994, Swetnam et al. 1995, Keen and Miller 1960).

Susceptibility ranges reflect combinations of species composition, forest structural stage, forest canopy layering, and stand density as components of insect or disease habitat; *ranges are assumed to represent insect or disease susceptibility associated with forest vegetation having little or no departure from reference conditions.*

When combining subcategory values for an insect or disease agent, susceptibility ranges will sum to 60-130% (a central tendency for this range is app. 100%). Nine insect or disease agents are included: *defoliators, Douglas-fir beetle, fir engraver, spruce beetle, bark beetles in ponderosa pine, mountain pine beetle in lodgepole pine, Douglas-fir dwarf mistletoe, western larch dwarf mistletoe, and root diseases.*

An important use of susceptibility ranges is for project planning, a process involving analysis of existing and desired conditions. Desired conditions are derived from several sources, including a Land and Resource Management Plan for a national forest (USDA Forest Service 1990).

When existing conditions deviate significantly from desired conditions, a purpose and need for a project is to modify existing conditions to be closer to desired conditions. A project's proposed action, and alternatives to it, examine various scenarios for how these modifications could occur.

Silvicultural practices, such as thinning or prescribed fire, are often proposed as actions for modifying vegetation conditions. And insect or disease susceptibility, the subject of this white paper, is frequently used as a desired condition (e.g., a specified level of insect or disease susceptibility) during project planning.

## **DRY UPLAND FOREST POTENTIAL VEGETATION GROUP**

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Powell and others (2007) describe potential vegetation composition, by plant association, for a Dry Upland Forest potential vegetation group (PVG) (see table 2 on page 20 of that source).

Dry forests occur at low to moderate elevations of a montane vegetation zone. Depending on plant association, late-seral, dry-forest stands are dominated by ponderosa pine, grand fir, or Douglas-fir as climax tree species, and ponderosa pine or Douglas-fir function as early- or mid-seral species. Western juniper is expanding rapidly into this PVG (Gedney et al. 1999) due to fire exclusion and climate change, moving upward from a foothills woodland zone located below the montane zone.

Dry forests are adjoined by moist upland forests at their upper edge, and by woodlands or shrublands of a foothills vegetation zone at their lower edge.

For the Blue Mountains, a Dry Upland Forest PVG consists of three plant association groups (PAG) – one from a warm temperature regime (Warm Dry PAG), and two from a hot temperature regime (Hot Moist PAG and Hot Dry PAG).

In terms of areal extent and geographical distribution, Warm Dry is the most abundant of three PAGs in a Dry Upland Forest PVG.

When considering Blue Mountains in their entirety, warm, dry forests tend to be the most common forest zone, and because they occur at low forested elevations, they have a long history of human use – both for commodity purposes (such as domestic livestock grazing and timber production), and as an area where effective fire exclusion occurred early on and eventually led to notable changes in species composition, forest structure, and stand density.

Dry-forest sites were historically dominated by ponderosa pine – a species well adapted to survive in a fire regime featuring low-severity surface fires occurring every 5 to 20 years. Now that dry forests have been substantially modified by human influences (fire exclusion, ungulate grazing, and selective timber harvest), dry-forest sites often experience crown fire instead of surface fire (Powell 2014).

Common dry-forest undergrowth species feature graminoids and mid-height shrubs. Elk sedge and pinegrass are ubiquitous graminoids, while birchleaf spiraea, snowberry, ninebark, and bitterbrush are common shrubs. On the very driest sites, a

Dry Upland Forest PVG has mountain-mahogany, big sagebrush, bluebunch wheatgrass, and western juniper (Hot Dry PAG).

Insect and disease agents of notable importance for dry-forest sites include defoliating insects (western spruce budworm and Douglas-fir tussock moth), Douglas-fir dwarf mistletoe, and bark beetles in ponderosa pine.

Recent high levels of defoliator activity on dry-forest sites (budworm and tussock moth) reflect a significant tree species shift during the past 75 years – Douglas-fir and grand fir (two defoliator host species) were able to invade sites historically dominated by non-host ponderosa pine because human activity suppressed a native disturbance regime – surface fire occurring on a frequency of 5-20 years.



*Dry upland forest example, showing moderate canopy cover of ponderosa pine, and undergrowth dominance by graminoids (primarily elk sedge and pinegrass). This stand is beginning to transition toward a multi-layered condition, and away from a single-layer structure produced by historical fire regimes.*

## Historical Vegetation Conditions for Dry Upland Forests

Estimates of historical species composition, forest structural stage, forest canopy layering, and tree (stand) density conditions for Dry UF landscapes with **little or no departure from reference conditions** are:

- a. Species composition
  - ponderosa pine: **50-90%**
  - Douglas-fir: **5-20%**
  - grand fir: **5-10%**
  - lodgepole pine: **0-5%**
  - western larch: **0-5%**
- b. Forest structural stage
  - stand initiation (tree diameter <5"): **5-15%**
  - stem exclusion (tree diameter 5-20"): **10-25%**
  - understory reinitiation (tree diameter 5-20"): **10-25%**
  - old forest (tree diameter ≥21"): **35-65%**
- c. Forest canopy layering
  - single layer: **45-85%**
  - multiple layers (>1): **15-45%**

- d. Stand density (mixed species at a quadratic mean diameter of 10 inches)
- |   |               |
|---|---------------|
| low (<40% canopy cover; <45 ft <sup>2</sup> /ac basal area; <81 sdi <sup>2</sup> or tpa): | <b>40-85%</b> |
| moderate (40-50% cover; 45-70 ft <sup>2</sup> /ac basal area; 81-121 sdi or tpa):         | <b>15-30%</b> |
| high (>50% canopy cover; >70 ft <sup>2</sup> /ac basal area; >121 sdi or tpa):            | <b>5-15%</b>  |

## **Insect and Disease Susceptibility for Dry Upland Forests**

Estimates of insect or disease susceptibility associated with historical vegetation conditions described above for Dry Upland Forests are:

1. Susceptibility to defoliators for historical Dry UF vegetation conditions
 

low (percentage as a range):	<b>40-85%</b>
moderate (percentage as a range):	<b>15-30%</b>
high (percentage as a range):	<b>5-15%</b>
2. Susceptibility to Douglas-fir beetle for historical Dry UF vegetation conditions
 

low (percentage as a range):	<b>35-75%</b>
moderate (percentage as a range):	<b>15-30%</b>
high (percentage as a range):	<b>10-25%</b>
3. Susceptibility to fir engraver for historical Dry UF vegetation conditions
 

low (percentage as a range):	<b>45-95%</b>
moderate (percentage as a range):	<b>10-25%</b>
high (percentage as a range):	<b>5-10%</b>
4. Susceptibility to spruce beetle for historical Dry UF vegetation conditions
 

low (percentage as a range):	<b>N/A</b>
moderate (percentage as a range):	<b>N/A</b>
high (percentage as a range):	<b>N/A</b>
5. Susceptibility to bark beetles in ponderosa pine for historical Dry UF vegetation conditions
 

low (percentage as a range):	<b>35-75%</b>
moderate (percentage as a range):	<b>15-35%</b>
high (percentage as a range):	<b>10-20%</b>
6. Susceptibility to mountain pine beetle in lodgepole pine for historical Dry UF vegetation conditions
 

low (percentage as a range):	<b>55-90%</b>
moderate (percentage as a range):	<b>5-35%</b>
high (percentage as a range):	<b>0-5%</b>
7. Susceptibility to Douglas-fir dwarf mistletoe for historical Dry UF vegetation conditions
 

low (percentage as a range):	<b>30-60%</b>
moderate (percentage as a range):	<b>10-35%</b>
high (percentage as a range):	<b>20-35%</b>

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<sup>2</sup> Tpa and sdi values are identical because stand density index refers to a 10" quadratic mean diameter, so sdi and tpa values are the same when QMD is 10" (but they are not the same when QMD is anything other than 10").

8. Susceptibility to western larch dwarf mistletoe for historical Dry UF vegetation conditions
 

low (percentage as a range):	<b>55-95%</b>
moderate (percentage as a range):	<b>5-30%</b>
high (percentage as a range):	<b>0-5%</b>
9. Susceptibility to root diseases for historical Dry UF vegetation conditions
 

low (percentage as a range):	<b>35-75%</b>
moderate (percentage as a range):	<b>20-35%</b>
high (percentage as a range):	<b>5-20%</b>

## MOIST UPLAND FOREST POTENTIAL VEGETATION GROUP

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Powell and others (2007) describe potential vegetation composition, by plant association, for a Moist Upland Forest potential vegetation group (PVG) (see table 2, pages 19-20, of that source).

Moist upland forests tend to occur at moderate elevations in a montane vegetation zone, or at low elevations of a subalpine zone. Late-seral stands are dominated by subalpine fir, grand fir, or Douglas-fir as climax tree dominants, while lodgepole pine or western larch often occur as early-seral species in this PVG.

Douglas-fir and western white pine function as mid-seral species in this PVG (except on sites where Douglas-fir is climax).

Moist forests are adjoined by cold upland forests at their upper edge, and by dry upland forests at their lower edge.

For the Blue Mountains, a Moist Upland Forest PVG consists of five plant association groups (PAG) – three in a cool temperature regime (Cool Wet, Cool Very Moist, and Cool Moist PAGs), and two in a warm temperature regime (Warm Very Moist and Warm Moist PAGs). Cool Moist PAG is by far and away the most common member of a Moist Upland Forest PVG.

Cool, moist forests tend to occupy the most productive forested environments of the Blue Mountains because moisture is usually not limiting – a temperate nature for this PAG is reflected in relatively high species diversity and a closed forest structure. High species diversity relates to both overstory (forest) composition and to the undergrowth plant union.

Moist-forest undergrowths are dominated by forbs, some mid-height shrubs, and a few tall shrubs on warmer environments. Moist-site plants such as queencup beadlily, twinflower, false bugbane, swordfern, and ginger occur in this zone, but the most common mesic environments within a Moist Upland Forest PVG have big huckleberry as an undergrowth dominant.

Moist forests at a warm end of the temperature spectrum feature mid or tall shrubs such as Rocky Mountain maple, ninebark, and oceanspray – these occur in Warm Very Moist and Warm Moist plant association groups.



Insect and disease agents of notable importance for moist-forest sites include defoliating insects such as western spruce budworm and Douglas-fir tussock moth, Douglas-fir beetle, fir engraver, spruce beetle, mountain pine beetle in lodgepole pine, Douglas-fir dwarf mistletoe, western larch dwarf mistletoe, stem decay caused by rust red stringy rot, and several different root diseases (particularly Armillaria and annosus root diseases, along with localized occurrences of laminated root rot).



*Example of a moist upland forest site, showing a relatively dense overstory canopy of grand fir and an undergrowth dominated by low forbs (primarily ginger, twinflower, and darkwoods violet on this site). Note a dense bracken stand immediately behind the large trees, and Sitka alder in a small opening behind the bracken fern.*

## Historical Vegetation Conditions for Moist Upland Forests

Estimates of historical species composition, forest structural stage, forest canopy layering, and tree (stand) density conditions for Moist UF landscapes with **little or no departure from reference conditions are:**

- a. Species composition
 

ponderosa pine:	<b>5-15%</b>
Douglas-fir:	<b>15-25%</b>
western larch:	<b>15-25%</b>
lodgepole pine:	<b>10-25%</b>
grand fir:	<b>15-30%</b>
Engelmann spruce-subalpine fir:	<b>0-10%</b>
- b. Forest structural stage
 

stand initiation (tree diameter <5"):	<b>5-15%</b>
stem exclusion (tree diameter 5-20"):	<b>5-30%</b>
understory reinitiation (tree diameter 5-20"):	<b>30-45%</b>
old forest (tree diameter ≥21"):	<b>20-40%</b>
- c. Forest canopy layering
 

single layer:	<b>10-45%</b>
multiple layers (>1):	<b>50-85%</b>

- d. Stand density (mixed species at a quadratic mean diameter of 10 inches)
- |  |               |
|--|---------------|
| low (<75% canopy cover; <90 ft <sup>2</sup> /ac basal area; <163 sdi <sup>3</sup> or tpa): | <b>20-40%</b> |
| moderate (75-85% cover; 90-135 ft <sup>2</sup> /ac basal area; 163-244 sdi or tpa):        | <b>25-60%</b> |
| high (>85% canopy cover; >135 ft <sup>2</sup> /ac basal area; >244 sdi or tpa):            | <b>15-30%</b> |

## **Insect and Disease Susceptibility for Moist Upland Forests**

Estimates of insect or disease susceptibility associated with historical vegetation conditions described above for Moist Upland Forests are:

1. Susceptibility to defoliators for historical Moist UF vegetation conditions
 

low (percentage as a range):	<b>5-20%</b>
moderate (percentage as a range):	<b>20-30%</b>
high (percentage as a range):	<b>35-80%</b>
2. Susceptibility to Douglas-fir beetle for historical Moist UF veg. conditions
 

low (percentage as a range):	<b>30-60%</b>
moderate (percentage as a range):	<b>20-40%</b>
high (percentage as a range):	<b>10-30%</b>
3. Susceptibility to fir engraver for historical Moist UF vegetation conditions
 

low (percentage as a range):	<b>30-70%</b>
moderate (percentage as a range):	<b>10-20%</b>
high (percentage as a range):	<b>20-40%</b>
4. Susceptibility to spruce beetle for historical Moist UF vegetation conditions
 

low (percentage as a range):	<b>50-95%</b>
moderate (percentage as a range):	<b>10-25%</b>
high (percentage as a range):	<b>0-10%</b>
5. Susceptibility to bark beetles in ponderosa pine for historical Moist UF vegetation conditions
 

low (percentage as a range):	<b>30-65%</b>
moderate (percentage as a range):	<b>15-30%</b>
high (percentage as a range):	<b>15-35%</b>
6. Susceptibility to mountain pine beetle in lodgepole pine for historical Moist UF vegetation conditions
 

low (percentage as a range):	<b>30-60%</b>
moderate (percentage as a range):	<b>25-40%</b>
high (percentage as a range):	<b>5-30%</b>
7. Susceptibility to Douglas-fir dwarf mistletoe for historical Moist UF vegetation conditions
 

low (percentage as a range):	<b>30-65%</b>
moderate (percentage as a range):	<b>20-45%</b>
high (percentage as a range):	<b>10-20%</b>

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<sup>3</sup> See footnote 2.



8. Susceptibility to western larch dwarf mistletoe for historical Moist UF vegetation conditions
 

low (percentage as a range):	<b>5-20%</b>
moderate (percentage as a range):	<b>15-40%</b>
high (percentage as a range):	<b>40-70%</b>
9. Susceptibility to root diseases for historical Moist UF vegetation conditions
 

low (percentage as a range):	<b>5-25%</b>
moderate (percentage as a range):	<b>20-40%</b>
high (percentage as a range):	<b>35-65%</b>

## **COLD UPLAND FOREST POTENTIAL VEGETATION GROUP**

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Powell and others (2007) describe potential vegetation composition, by plant association, for a Cold Upland Forest potential vegetation group (PVG) (see table 2 on pages 18-19 of that source).

Cold upland forests tend to occur at moderate or high elevations in a subalpine zone. Late-seral stands are dominated by subalpine fir or Engelmann spruce as climax tree dominants, while lodgepole pine or whitebark pine often function as persistent, early-seral species.

Cold forests are adjoined by a treeless alpine zone at their upper edge (sometimes separated by a narrow zone of dwarf or krummholz trees at upper treeline), and by moist upland forests at their lower edge.

For the Blue Mountains, a Cold Upland Forest PVG consists of three plant association groups (PAG) – two in a cold temperature regime (Cold Moist and Cold Dry PAGs), and one in a cool temperature regime (Cool Dry PAG). Cold Dry PAG is by far and away the most common member of a Cold Upland Forest PVG.

Cold, dry subalpine forests (Cold Dry PAG) tend to be the most xeric of upper-elevation forested communities, often occurring on west- to south-facing slopes with moderate or high impact from wind scour. Due to wind effects, shallow soils, and other abiotic factors, many cold dry forests have an open canopy structure.

These sites are often above the cold tolerance limits for Douglas-fir, but this species is sometimes found as a mid-seral species on sheltered landform positions.

Common cold-forest undergrowth species are dominated by herbs and dwarf shrubs. Areas with physiographic and soil characteristics suitable for supporting forests with at least moderate canopy cover frequently have one or more of the ericaceous *Vaccinium* species as undergrowth dominants (generally *Vaccinium scoparium*, but sometimes *V. cespitosum* or *V. myrtillus*).

Areas with steep slopes or shallow soils support open-canopy stands and an herb-dominated undergrowth featuring elk sedge, Ross' sedge, needlegrass, or green fescue.

Cold upland forests at high elevations tend to feature a persistent component of whitebark pine, and these communities often have an undergrowth reminiscent of al-

pine flora found above the forest zone (including species such as sandwort, mountain-heath, fleecflower, etc.).

Insect and disease agents of notable importance for cold forests include spruce beetle, mountain pine beetle in lodgepole pine, and western larch dwarf mistletoe.



*Example of a cold upland forest site, showing a relatively open overstory canopy of Engelmann spruce and subalpine fir, and an undergrowth dominated by low ericaceous shrubs (Vaccinium scoparium and V. myrtillus on this site).*

## Historical Vegetation Conditions for Cold Upland Forests

Estimates of historical species composition, forest structural stage, forest canopy layering, and tree (stand) density conditions for Cold UF landscapes with **little or no departure from reference conditions are:**

- a. Species composition
 

ponderosa pine:	<b>0-5%</b>
Douglas-fir:	<b>5-15%</b>
western larch:	<b>5-15%</b>
lodgepole pine:	<b>25-45%</b>
grand fir:	<b>5-15%</b>
Engelmann spruce-subalpine fir:	<b>20-35%</b>
- b. Forest structural stage
 

stand initiation (tree diameter <5"):	<b>10-30%</b>
stem exclusion (tree diameter 5-20"):	<b>15-35%</b>
understory reinitiation (tree diameter 5-20"):	<b>5-20%</b>
old forest (tree diameter ≥21"):	<b>30-45%</b>
- c. Forest canopy layering
 

single layer:	<b>25-65%</b>
multiple layers (>1):	<b>35-65%</b>
- d. Stand density (mixed species at a quadratic mean diameter of 10 inches)
 

low (<60% canopy cover; <70 ft <sup>2</sup> /ac basal area; <132 sdi <sup>4</sup> or tpa):	<b>15-30%</b>
moderate (60-70% cover; 70-110 ft <sup>2</sup> /ac basal area; 132-197 sdi or tpa):	<b>20-40%</b>
high (>70% canopy cover; >110 ft <sup>2</sup> /ac basal area; >197 sdi or tpa):	<b>25-60%</b>

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<sup>4</sup> See footnote 2.

## **Insect and Disease Susceptibility for Cold Upland Forests**

Estimates of insect or disease susceptibility associated with historical vegetation conditions described above for Cold Upland Forests are:

1. Susceptibility to defoliators for historical Cold UF vegetation conditions
  - low (percentage as a range): **40-95%**
  - moderate (percentage as a range): **15-25%**
  - high (percentage as a range): **5-10%**
2. Susceptibility to Douglas-fir beetle for historical Cold UF veg. conditions
  - low (percentage as a range): **45-95%**
  - moderate (percentage as a range): **10-25%**
  - high (percentage as a range): **5-10%**
3. Susceptibility to fir engraver for historical Cold UF vegetation conditions
  - low (percentage as a range): **35-75%**
  - moderate (percentage as a range): **20-45%**
  - high (percentage as a range): **5-10%**
4. Susceptibility to spruce beetle for historical Cold UF vegetation conditions
  - low (percentage as a range): **10-30%**
  - moderate (percentage as a range): **30-50%**
  - high (percentage as a range): **20-50%**
5. Susceptibility to bark beetles in ponderosa pine for historical Cold UF vegetation conditions
  - low (percentage as a range): **55-95%**
  - moderate (percentage as a range): **5-30%**
  - high (percentage as a range): **0-5%**
6. Susceptibility to mountain pine beetle in lodgepole pine for historical Cold UF vegetation conditions
  - low (percentage as a range): **30-50%**
  - moderate (percentage as a range): **15-40%**
  - high (percentage as a range): **15-40%**
7. Susceptibility to Douglas-fir dwarf mistletoe for historical Cold UF conditions
  - low (percentage as a range): **40-90%**
  - moderate (percentage as a range): **20-30%**
  - high (percentage as a range): **0-10%**
8. Susceptibility to western larch dwarf mistletoe for historical Cold UF vegetation conditions
  - low (percentage as a range): **10-20%**
  - moderate (percentage as a range): **20-50%**
  - high (percentage as a range): **30-60%**
9. Susceptibility to root diseases for historical Cold UF vegetation conditions
  - low (percentage as a range): **30-65%**
  - moderate (percentage as a range): **20-45%**
  - high (percentage as a range): **10-20%**

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# **Appendix 1: Potential vegetation types (PVT) for Blue Mountains section (from Powell et al. 2007)<sup>1</sup>**

PVT CODE	PVT COMMON NAME	STATUS	ECOCCLASS	PAG	PVG
ABGR/ACGL	grand fir/Rocky Mountain maple	PA	CWS912	Warm Very Moist UF	Moist UF
ABGR/ACGL (FLOODPLAIN)	grand fir/Rocky Mountain maple (floodplain)	PA	CWS543	Warm Moderate SM RF	Moderate SM RF
ABGR/ACGL-PHMA	grand fir/Rocky Mountain maple-ninebark	PCT	CWS412	Warm Moist UF	Moist UF
ABGR/ARCO	grand fir/heartleaf arnica	PCT	CWF444	Cold Dry UF	Cold UF
ABGR/ATFI	grand fir/ladyfern	PA	CWF613	Warm High SM RF	High SM RF
ABGR/BRVU	grand fir/Columbia brome	PA	CWG211	Warm Moist UF	Moist UF
ABGR/CAGE	grand fir/elk sedge	PA	CWG111	Warm Dry UF	Dry UF
ABGR/CALA3	grand fir/woolly sedge	PC	CWM311	Warm High SM RF	High SM RF
ABGR/CARU	grand fir/pinegrass	PA	CWG112	Warm Dry UF	Dry UF
ABGR/CLUN	grand fir/queencup beadlily	PA	CWF421	Cool Moist UF	Moist UF
ABGR/COOC2	grand fir/goldthread	PA	CWF511	Cool Dry UF	Cold UF
ABGR/GYDR	grand fir/oakfern	PA	CWF611	Cool Very Moist UF	Moist UF
ABGR/LIBO2	grand fir/twinflower	PA	CWF311	Cool Moist UF	Moist UF
ABGR/POMU-ASCA3	grand fir/sword fern-ginger	PA	CWF612	Cool Very Moist UF	Moist UF
ABGR/SPBE	grand fir/birchleaf spiraea	PA	CWS321	Warm Dry UF	Dry UF
ABGR/SYAL (FLOODPLAIN)	grand fir/common snowberry (floodplain)	PCT	CWS314	Warm Low SM RF	Low SM RF
ABGR/TABR/CLUN	grand fir/Pacific yew/queencup beadlily	PA	CWC811	Cool Wet UF	Moist UF
ABGR/TABR/LIBO2	grand fir/Pacific yew/twinflower	PA	CWC812	Cool Wet UF	Moist UF
ABGR/TRCA3	grand fir/false bugbane	PA	CWF512	Cool Very Moist UF	Moist UF
ABGR/VAME	grand fir/big huckleberry	PA	CWS211	Cool Moist UF	Moist UF
ABGR/VASC	grand fir/grouse huckleberry	PA	CWS811	Cold Dry UF	Cold UF
ABGR/VASC-LIBO2	grand fir/grouse huckleberry-twinflower	PA	CWS812	Cool Moist UF	Moist UF
ABGR-CHNO/VAME	grand fir-Alaska yellow cedar/big huckleberry	PCT	CWS232	Cool Moist UF	Moist UF
ABLA2/ARCO	subalpine fir/heartleaf arnica	PCT	CEF412	Cool Moist UF	Moist UF
ABLA2/ATFI	subalpine fir/ladyfern	PA	CEF332	Cold High SM RF	High SM RF
ABLA2/CAAQ	subalpine fir/aquatic sedge	PCT	CEM123	Cold High SM RF	High SM RF
ABLA2/CACA	subalpine fir/bluejoint reedgrass	PA	CEM124	Cold Moderate SM RF	Moderate SM RF
ABLA2/CADI	subalpine fir/softleaved sedge	PCT	CEM122	Cold High SM RF	High SM RF
ABLA2/CAGE	subalpine fir/elk sedge	PA	CAG111	Cold Dry UF	Cold UF
ABLA2/CARU	subalpine fir/pinegrass	PCT	CEG312	Cool Dry UF	Cold UF
ABLA2/CLUN	subalpine fir/queencup beadlily	PA	CES131	Cool Moist UF	Moist UF
ABLA2/LIBO2	subalpine fir/twinflower	PA	CES414	Cool Moist UF	Moist UF
ABLA2/MEFE	subalpine fir/fool's huckleberry	PA	CES221	Cold Moist UF	Cold UF
ABLA2/POPU	subalpine fir/skunkleaved polemonium	PCT	CEF411	Cold Dry UF	Cold UF
ABLA2/RHAL	subalpine fir/white rhododendron	PCT	CES214	Cold Moist UF	Cold UF
ABLA2/SETR	subalpine fir/arrowleaf groundsel	PA	CEF333	Cold High SM RF	High SM RF
ABLA2/STAM	subalpine fir/twisted stalk	PCT	CEF311	Cool Wet UF	Moist UF
ABLA2/STOC	subalpine fir/western needlegrass	PCT	CAG4	Cold Dry UF	Cold UF

PVT CODE	PVT COMMON NAME	STATUS	ECOCCLASS	PAG	PVG
ABLA2/TRCA3	subalpine fir/false bugbane	PA	CEF331	Cool Moist UF	Moist UF
ABLA2/VAME	subalpine fir/big huckleberry	PA	CES311	Cool Moist UF	Moist UF
ABLA2/VASC	subalpine fir/grouse huckleberry	PA	CES411	Cold Dry UF	Cold UF
ABLA2/VASC/POPU	subalpine fir/grouse huckleberry/skunkleaved polemonium	PA	CES415	Cold Dry UF	Cold UF
ABLA2/VAUL/CASC5	subalpine fir/bog blueberry/Holm's sedge	PCT	CEM313	Cold High SM RF	High SM RF
ABLA2-PIAL/JUDR	subalpine fir-whitebark pine/Drummond's rush	PCT	CAG3	Cold Dry UF	Cold UF
ABLA2-PIAL/POPH	subalpine fir-whitebark pine/fleeceflower	PCT	CAF2	Cold Dry UF	Cold UF
ABLA2-PIAL/POPU	subalpine fir-whitebark pine/skunkleaved polemonium	PCT	CAF0	Cold Dry UF	Cold UF
ADPE	maidenhair fern	PCT	FW4213	Warm High SM RH	High SM RH
AGDI	thin bentgrass	PCT	MD4111	Warm Low SM RH	Low SM RH
AGSP	bluebunch wheatgrass	PA	GB41	Hot Dry UH	Dry UH
AGSP-ERHE	bluebunch wheatgrass-Wyeth's buckwheat	PA	GB4111	Hot Dry UH	Dry UH
AGSP-POSA3	bluebunch wheatgrass-Sandberg's bluegrass	PA	GB4121	Hot Dry UH	Dry UH
AGSP-POSA3-ASCU4	bluebunch wheatgrass-Sandberg's bluegrass-Cusick's milkvetch	PA	GB4114	Hot Dry UH	Dry UH
AGSP-POSA3 (BASALT)	bluebunch wheatgrass-Sandberg's bluegrass (basalt)	PA	GB4113	Hot Dry UH	Dry UH
AGSP-POSA3-DAUN	bluebunch wheatgrass-Sandberg's bluegrass-onespike oatgrass	PA	GB4911	Hot Dry UH	Dry UH
AGSP-POSA3-ERPU	bluebunch wheatgrass-Sandberg's bluegrass-shaggy fleabane	PA	GB4115	Hot Dry UH	Dry UH
AGSP-POSA3 (GRANITE)	bluebunch wheatgrass-Sandberg's bluegrass (granite)	PA	GB4116	Hot Dry UH	Dry UH
AGSP-POSA3-OPPO	bluebunch wheatgrass-Sandberg's bluegrass-pricklypear	PA	GB4118	Hot Dry UH	Dry UH
AGSP-POSA3-PHCO2	bluebunch wheatgrass-Sandberg's bluegrass-Snake River phlox	PA	GB4117	Hot Dry UH	Dry UH
AGSP-POSA3-SCAN	bluebunch wheatgrass-Sandberg's bluegrass-narrowleaf skullcap	PA	GB4112	Hot Dry UH	Dry UH
AGSP-SPCR-ARLO3	bluebunch wheatgrass-sand dropseed-red threeawn	PCT	GB1911	Hot Dry UH	Dry UH
ALIN/ATFI	mountain alder/ladyfern	PA	SW2116	Warm High SM RS	High SM RS
ALIN/CAAM	mountain alder/bigleaved sedge	PA	SW2114	Warm High SM RS	High SM RS
ALIN/CAAQ	mountain alder/aquatic sedge	PC	SW2126	Warm High SM RS	High SM RS
ALIN/CACA	mountain alder/bluejoint reedgrass	PA	SW2121	Warm Moderate SM RS	Moderate SM RS
ALIN/CADE	mountain alder/Dewey's sedge	PCT	SW2118	Warm Moderate SM RS	Moderate SM RS
ALIN/CALA3	mountain alder/woolly sedge	PA	SW2123	Warm Moderate SM RS	Moderate SM RS
ALIN/CALEL2	mountain alder/densely tufted sedge	PC	SW2127	Warm Moderate SM RS	Moderate SM RS
ALIN/CALU	mountain alder/woodrush sedge	PC	SW2128	Warm Low SM RS	Low SM RS
ALIN/CAUT	mountain alder/bladder sedge	PA	SW2115	Warm High SM RS	High SM RS
ALIN/EQAR	mountain alder/common horsetail	PA	SW2117	Warm Moderate SM RS	Moderate SM RS
ALIN/GLEL	mountain alder/tall mannagrass	PA	SW2215	Warm High SM RS	High SM RS
ALIN/GYDR	mountain alder/oakfern	PCT	SW2125	Warm Moderate SM RS	Moderate SM RS
ALIN/HELA	mountain alder/common cowparsnip	PCT	SW2124	Warm Moderate SM RS	Moderate SM RS
ALIN/POPR	mountain alder/Kentucky bluegrass	PCT	SW2120	Warm Low SM RS	Low SM RS
ALIN/SCMI	mountain alder/smallfruit bulrush	PCT	SW2122	Warm High SM RS	High SM RS
ALIN-COST/MESIC FORB	mountain alder-redosier dogwood/mesic forb	PA	SW2216	Warm Moderate SM RS	Moderate SM RS
ALIN-RIBES/MESIC FORB	mountain alder-currants/mesic forb	PA	SW2217	Warm Moderate SM RS	Moderate SM RS
ALIN-SYAL	mountain alder-common snowberry	PA	SW2211	Warm Low SM RS	Low SM RS



PVT CODE	PVT COMMON NAME	STATUS	ECOCCLASS	PAG	PVG
ALPR	meadow foxtail	PCT	MD2111	Warm Low SM RH	Low SM RH
ALRU (ALLUVIAL BAR)	red alder (alluvial bar)	PCT	HAF226	Warm Moderate SM RF	Moderate SM RF
ALRU/ATFI	red alder/ladyfern	PCT	HAF227	Warm High SM RF	High SM RF
ALRU/COST	red alder/redosier dogwood	PC	HAS511	Warm Moderate SM RF	Moderate SM RF
ALRU/PEFRP	red alder/sweet coltsfoot	PCT	HAF211	Warm Moderate SM RF	Moderate SM RF
ALRU/PHCA3	red alder/Pacific ninebark	PA	HAS211	Warm Moderate SM RF	Moderate SM RF
ALRU/SYAL	red alder/common snowberry	PCT	HAS312	Warm Moderate SM RF	Moderate SM RF
ALSI	Sitka alder snow slides	PCT	SM20	Cold Very Moist US	Cold US
ALSI/ATFI	Sitka alder/ladyfern	PA	SW2111	Warm High SM RS	High SM RS
ALSI/CILA2	Sitka alder/drooping woodreed	PA	SW2112	Warm High SM RS	High SM RS
ALSI/MESIC FORB	Sitka alder/mesic forb	PCT	SW2113	Warm Moderate SM RS	Moderate SM RS
ALVA	swamp onion	PCT	FW7111	Cold High SM RH	High SM RH
AMAL	western serviceberry	PCT	SW3114	Hot Low SM RS	Low SM RS
ARAR/FEID-AGSP	low sagebrush/Idaho fescue-bluebunch wheatgrass	PA	SD1911	Warm Moist US	Moist US
ARAR/POSA3	low sagebrush/Sandberg's bluegrass	PA	SD9221	Hot Dry US	Dry US
ARCA/DECE	silver sagebrush/tufted hairgrass	PA	SW6111	Hot Moderate SM RS	Moderate SM RS
ARCA/POCU	silver sagebrush/Cusick's bluegrass	PCT	SW6114	Hot Low SM RS	Low SM RS
ARCA/POPR	silver sagebrush/Kentucky bluegrass	PCT	SW6112	Hot Low SM RS	Low SM RS
ARRI/POSA3	stiff sagebrush/Sandberg's bluegrass	PCT	SD9111	Hot Dry US	Dry US
ARTRV/BRCA	mountain big sagebrush/mountain brome	PCT	SS4914	Warm Moist US	Moist US
ARTRV/CAGE	mountain big sagebrush/elk sedge	PA	SS4911	Cold Moist US	Cold US
ARTRV/FEID-AGSP	mountain big sagebrush/Idaho fescue-bluebunch wheatgrass	PA	SD2911	Warm Moist US	Moist US
ARTRV/POCU	mountain big sagebrush/Cusick's bluegrass	PA	SW6113	Hot Low SM RS	Low SM RS
ARTRV/STOC	mountain big sagebrush/western needlegrass	PCT	SS4915	Cool Dry US	Cold US
ARTRV-PUTR/FEID	mountain big sagebrush-bitterbrush/Idaho fescue	PCT	SD2916	Hot Moist US	Moist US
ARTRV-SYOR/BRCA	mountain big sagebrush-mountain snowberry/mountain brome	PCT	SD2917	Warm Moist US	Moist US
BEOC/MESIC FORB	water birch/mesic forb	PCT	SW3112	Warm Moderate SM RS	Moderate SM RS
BEOC/WET SEDGE	water birch/wet sedge	PCT	SW3113	Warm High SM RS	High SM RS
CAAM	bigleaved sedge	PA	MM2921	Warm High SM RH	High SM RH
CAAQ	aquatic sedge	PA	MM2914	Warm High SM RH	High SM RH
CACA	bluejoint reedgrass	PA	GM4111	Warm Moderate SM RH	Moderate SM RH
CACA4	silvery sedge	PCT	MS3113	Warm Moderate SM RH	Moderate SM RH
CACU (SEEP)	Cusick's camas (seep)	PCT	FW3911	Warm Very Moist UH	Moist UH
CACU2	Cusick's sedge	PA	MM2918	Warm High SM RH	High SM RH
CAGE (ALPINE)	elk sedge (alpine)	PCT	GS3911	Cold Dry UH	Cold UH
CAGE (UPLAND)	elk sedge (upland)	PCT	GS39	Cool Dry UH	Cold UH
CAHO	Hood's sedge	PCT	GS3912	Cool Moist UH	Cold UH
CALA	smoothstemmed sedge	PC	MW2913	Cold High SM RH	High SM RH
CALA3	woolly sedge	PA	MM2911	Warm Moderate SM RH	Moderate SM RH
CALA4	slender sedge	PC	MM2920	Warm High SM RH	High SM RH

PVT CODE	PVT COMMON NAME	STATUS	ECOCCLASS	PAG	PVG
CALEL2	densely tufted sedge	PA	MM2919	Warm Moderate SM RH	Moderate SM RH
CALU	woodrush sedge	PA	MM2916	Cold High SM RH	High SM RH
CAMU2	star sedge	PCT	MS3112	Warm Moderate SM RH	Moderate SM RH
CANE	Nebraska sedge	PCT	MM2912	Hot Moderate SM RH	Moderate SM RH
CANU4	torrent sedge	PCT	MM2922	Hot High SM RH	High SM RH
CAPR5	clustered field sedge	PCT	MW2912	Cold High SM RH	High SM RH
CASC5	Holm's sedge	PA	MS3111	Cold High SM RH	High SM RH
CASH	Sheldon's sedge	PCT	MM2932	Hot Moderate SM RH	Moderate SM RH
CASI2	shortbeaked sedge	PCT	MM2915	Warm High SM RH	High SM RH
CAST	sawbeak sedge	PCT	MW1926	Warm High SM RH	High SM RH
CAUT	bladder sedge	PA	MM2917	Warm High SM RH	High SM RH
CAVEV	inflated sedge	PA	MW1923	Warm High SM RH	High SM RH
CELE/CAGE	mountain mahogany/elk sedge	PCT	SD40	Hot Moist US	Moist US
CELE/FEID-AGSP	mountain mahogany/Idaho fescue-bluebunch wheatgrass	PA	SD4111	Hot Moist US	Moist US
CERE2/AGSP	netleaf hackberry/bluebunch wheatgrass	PA	SD5611	Hot Moist US	Moist US
CEVE	snowbrush ceanothus	PCT	SM33	Warm Moist US	Moist US
CILA2	drooping woodreed	PC	MW2927	Cold High SM RH	High SM RH
COST	redosier dogwood	PA	SW5112	Hot Moderate SM RS	Moderate SM RS
COST/SAAR4	redosier dogwood/brook saxifrage	PCT	SW5118	Warm High SM RS	High SM RS
CRDO	Douglas hawthorne	PCT	SW3111	Hot Low SM RS	Low SM RS
DECE	tufted hairgrass	PA	MM1912	Warm Moderate SM RH	Moderate SM RH
ELBE	delicate spikerush	PC	MS4111	Cold High SM RH	High SM RH
ELCI	basin wildrye	PA	GB7111	Hot Very Moist UH	Moist UH
ELPA	creeping spikerush	PA	MW4912	Hot High SM RH	High SM RH
ELPA2	fewflowered spikerush	PCT	MW4911	Cold High SM RH	High SM RH
EQAR	common horsetail	PA	FW4212	Warm Moderate SM RH	Moderate SM RH
ERDO-POSA3	Douglas buckwheat/Sandberg's bluegrass	PCT	FM9111	Hot Dry UH	Dry UH
ERIOG/PHOR	buckwheat/Oregon bladderpod	PA	SD9322	Hot Dry UH	Dry UH
ERST2-POSA3	strict buckwheat/Sandberg's bluegrass	PCT	FM9112	Hot Dry UH	Dry UH
ERUM (RIDGE)	sulphurflower (ridge)	PCT	FM9113	Hot Dry UH	Dry UH
FEID (ALPINE)	Idaho fescue (alpine)	PCT	GS12	Cold Moist UH	Cold UH
FEID-AGSP	Idaho fescue-bluebunch wheatgrass	PA	GB59	Warm Moist UH	Moist UH
FEID-AGSP (RIDGE)	Idaho fescue-bluebunch wheatgrass (ridge)	PCT	GB5915	Warm Moist UH	Moist UH
FEID-AGSP-BASA	Idaho fescue-bluebunch wheatgrass-balsamroot	PA	GB5917	Warm Moist UH	Moist UH
FEID-AGSP-LUSE	Idaho fescue-bluebunch wheatgrass-silky lupine	PA	GB5916	Warm Moist UH	Moist UH
FEID-AGSP-PHCO2	Idaho fescue-bluebunch wheatgrass-Snake River phlox	PA	GB5918	Warm Moist UH	Moist UH
FEID-CAGE	Idaho fescue-elk sedge	PCT	GB5922	Warm Moist UH	Moist UH
FEID-CAHO	Idaho fescue-Hood's sedge	PA	GB5921	Warm Moist UH	Moist UH
FEID-DAIN-CAREX	Idaho fescue-timber oatgrass-sedge	PA	GB5920	Warm Very Moist UH	Moist UH
FEID-KOCR (HIGH)	Idaho fescue-prairie junegrass (high)	PA	GB5913	Cool Moist UH	Cold UH

PVT CODE	PVT COMMON NAME	STATUS	ECOCCLASS	PAG	PVG
FEID-KOCR (LOW)	Idaho fescue-prairie junegrass (low)	PA	GB5914	Warm Moist UH	Moist UH
FEID-KOCR (MOUND)	Idaho fescue-prairie junegrass (mound)	PA	GB5912	Cool Moist UH	Cold UH
FEID-KOCR (RIDGE)	Idaho fescue-prairie junegrass (ridge)	PA	GB5911	Cool Moist UH	Cold UH
FEVI	green fescue	PCT	GS11	Cold Moist UH	Cold UH
FEVI-CAHO	green fescue-Hood's sedge	PCT	GS1111	Cold Moist UH	Cold UH
FEVI-LULA2	green fescue-spurred lupine	PA	GS1112	Cold Moist UH	Cold UH
GLEL	tall mannagrass	PA	MM2925	Warm High SM RH	High SM RH
GLNE/AGSP	spiny greenbush/bluebunch wheatgrass	PA	SD65	Hot Dry US	Dry US
JUBA	Baltic rush	PCT	MW3912	Hot Moderate SM RH	Moderate SM RH
JUOC/ARAR	western juniper/low sagebrush	PCT	CJS1	Hot Dry UW	Dry UW
JUOC/ARRI	western juniper/stiff sagebrush	PCT	CJS8	Hot Dry UW	Dry UW
JUOC/ARTRV	western juniper/mountain big sagebrush	PCT	CJS2	Hot Moist UW	Moist UW
JUOC/ARTRV/FEID-AGSP	western juniper/mountain big sagebrush/fescue-wheatgrass	PA	CJS211	Hot Moist UW	Moist UW
JUOC/CELE/CAGE	western juniper/mountain mahogany/elk sedge	PCT	CJS42	Hot Moist UW	Moist UW
JUOC/CELE/FEID-AGSP	western juniper/mountain mahogany/fescue-wheatgrass	PCT	CJS41	Hot Moist UW	Moist UW
JUOC/FEID-AGSP	western juniper/Idaho fescue-bluebunch wheatgrass	PA	CJG111	Hot Moist UW	Moist UW
JUOC/PUTR/FEID-AGSP	western juniper/bitterbrush/Idaho fescue-bluebunch wheatgrass	PA	CJS321	Hot Moist UW	Moist UW
LECOW	Wallowa Lewisia	PCT	FX4111	Hot Dry UH	Dry UH
METR	buckbean	PC	FW6111	Warm High SM RH	High SM RH
PERA3-SYOR	squaw apple-mountain snowberry	PCT	SD30	Hot Moist US	Moist US
PHLE2 (TALUS)	syringa bordered strips (talus)	PCT	NTS111	Hot Very Moist US	Moist US
PHMA-SYAL	ninebark-common snowberry	PA	SM1111	Warm Moist US	Moist US
PICO(ABGR)/ALSI	lodgepole pine(grand fir)/Sitka alder	PCT	CLS58	Cool Very Moist UF	Moist UF
PICO(ABGR)/ARNE	lodgepole pine(grand fir)/pinemat manzanita	PCT	CLS57	Cool Dry UF	Cold UF
PICO(ABGR)/CARU	lodgepole pine(grand fir)/pinegrass	PCT	CLG21	Cool Dry UF	Cold UF
PICO(ABGR)/LIBO2	lodgepole pine(grand fir)/twinflower	PCT	CLF211	Cool Moist UF	Moist UF
PICO(ABGR)/VAME	lodgepole pine(grand fir)/big huckleberry	PCT	CLS513	Cool Moist UF	Moist UF
PICO(ABGR)/VAME/CARU	lodgepole pine(grand fir)/big huckleberry/pinegrass	PCT	CLS512	Cool Moist UF	Moist UF
PICO(ABGR)/VAME/PTAQ	lodgepole pine(grand fir)/big huckleberry/bracken	PCT	CLS519	Cool Moist UF	Moist UF
PICO(ABGR)/VASC/CARU	lodgepole pine(grand fir)/grouse huckleberry/pinegrass	PCT	CLS417	Cold Dry UF	Cold UF
PICO(ABLA2)/CAGE	lodgepole pine(subalpine fir)/elk sedge	PCT	CLG322	Cold Dry UF	Cold UF
PICO(ABLA2)/STOC	lodgepole pine(subalpine fir)/western needlegrass	PCT	CLG11	Cold Dry UF	Cold UF
PICO(ABLA2)/VAME	lodgepole pine(subalpine fir)/big huckleberry	PCT	CLS514	Cool Moist UF	Moist UF
PICO(ABLA2)/VAME/CARU	lodgepole pine(subalpine fir)/big huckleberry/pinegrass	PCT	CLS516	Cool Moist UF	Moist UF
PICO(ABLA2)/VASC	lodgepole pine(subalpine fir)/grouse huckleberry	PCT	CLS418	Cold Dry UF	Cold UF
PICO(ABLA2)/VASC/POPU	lodgepole pine(subalpine fir)/grouse huckleberry/polemonium	PCT	CLS415	Cold Dry UF	Cold UF
PICO/ALIN/MESIC FORB	lodgepole pine/mountain alder/mesic forb	PC	CLM511	Cold Moderate SM RF	Moderate SM RF
PICO/CAAQ	lodgepole pine/aquatic sedge	PA	CLM114	Cold High SM RF	High SM RF
PICO/CACA	lodgepole pine/bluejoint reedgrass	PC	CLM117	Cold Moderate SM RF	Moderate SM RF
PICO/CALA3	lodgepole pine/woolly sedge	PC	CLM116	Cold Moderate SM RF	Moderate RF

PVT CODE	PVT COMMON NAME	STATUS	ECOCCLASS	PAG	PVG
PICO/CARU	lodgepole pine/pinegrass	PA	CLS416	Cool Dry UF	Cold UF
PICO/DECE	lodgepole pine/tufted hairgrass	PA	CLM115	Cold Moderate SM RF	Moderate SM RF
PICO/POPR	lodgepole pine/Kentucky bluegrass	PCT	CLM112	Cold Low SM RF	Low SM RF
PIEN/ATFI	Engelmann spruce/ladyfern	PCT	CEF334	Cold High SM RF	High SM RF
PIEN/BRVU	Engelmann spruce/Columbia brome	PCT	CEM125	Cold Low SM RF	Low SM RF
PIEN/CADI	Engelmann spruce/softleaved sedge	PA	CEM121	Cold High SM RF	High SM RF
PIEN/CILA2	Engelmann spruce/drooping woodreed	PC	CEM126	Cold Moderate SM RF	Moderate SM RF
PIEN/COST	Engelmann spruce/redosier dogwood	PA	CES511	Cold Moderate SM RF	Moderate SM RF
PIEN/EQAR	Engelmann spruce/common horsetail	PA	CEM211	Cold Moderate SM RF	Moderate SM RF
PIEN/SETR	Engelmann spruce/arrowleaf groundsel	PCT	CEF335	Cold High SM RF	High SM RF
PIMO/DECE	western white pine/tufted hairgrass	PCT	CQM111	Warm Moderate SM RF	Moderate SM RF
PIPO/AGSP	ponderosa pine/bluebunch wheatgrass	PA	CPG111	Hot Dry UF	Dry UF
PIPO/ARAR	ponderosa pine/low sagebrush	PCT	CPS61	Hot Moist UF	Dry UF
PIPO/ARTRV/CAGE	ponderosa pine/mountain big sagebrush/elk sedge	PCT	CPS132	Hot Dry UF	Dry UF
PIPO/ARTRV/FEID-AGSP	ponderosa pine/mountain big sagebrush/fescue-wheatgrass	PA	CPS131	Hot Dry UF	Dry UF
PIPO/CAGE	ponderosa pine/elk sedge	PA	CPG222	Warm Dry UF	Dry UF
PIPO/CARU	ponderosa pine/pinegrass	PA	CPG221	Warm Dry UF	Dry UF
PIPO/CELE/CAGE	ponderosa pine/mountain mahogany/elk sedge	PA	CPS232	Warm Dry UF	Dry UF
PIPO/CELE/FEID-AGSP	ponderosa pine/mountain mahogany/fescue-wheatgrass	PA	CPS234	Hot Dry UF	Dry UF
PIPO/CELE/PONE	ponderosa pine/mountain mahogany/Wheeler's bluegrass	PA	CPS233	Hot Dry UF	Dry UF
PIPO/ELGL	ponderosa pine/blue wildrye	PA	CPM111	Warm Dry UF	Dry UF
PIPO/FEID	ponderosa pine/Idaho fescue	PA	CPG112	Hot Dry UF	Dry UF
PIPO/PERA3	ponderosa pine/squaw apple	PCT	CPS8	Hot Dry UF	Dry UF
PIPO/POPR	ponderosa pine/Kentucky bluegrass	PCT	CPM112	Hot Low SM RF	Low SM RF
PIPO/PUTR/AGSP	ponderosa pine/bitterbrush/bluebunch wheatgrass	PCT	CPS231	Hot Dry UF	Dry UF
PIPO/PUTR/CAGE	ponderosa pine/bitterbrush/elk sedge	PA	CPS222	Warm Dry UF	Dry UF
PIPO/PUTR/CARO	ponderosa pine/bitterbrush/Ross sedge	PA	CPS221	Warm Dry UF	Dry UF
PIPO/PUTR/FEID-AGSP	ponderosa pine/bitterbrush/Idaho fescue-bluebunch wheatgrass	PA	CPS226	Hot Dry UF	Dry UF
PIPO/RHGL	ponderosa pine/sumac	PCT	CPS9	Hot Dry UF	Dry UF
PIPO/SPBE	ponderosa pine/birchleaf spiraea	PCT	CPS523	Warm Dry UF	Dry UF
PIPO/SYAL	ponderosa pine/common snowberry	PA	CPS522	Warm Dry UF	Dry UF
PIPO/SYAL (FLOODPLAIN)	ponderosa pine/common snowberry (floodplain)	PA	CPS511	Hot Low SM RF	Low SM RF
PIPO/SYOR	ponderosa pine/mountain snowberry	PA	CPS525	Warm Dry UF	Dry UF
POFR/DECE	shrubby cinquefoil/tufted hairgrass	PA	SW5113	Warm Moderate SM RS	Moderate SM RS
POFR/POPR	shrubby cinquefoil/Kentucky bluegrass	PCT	SW5114	Warm Low SM RS	Low SM RS
POPR (DEGEN BENCH)	Kentucky bluegrass (degenerated bench)	PCT	MD3112	Cool Moist UH	Cold UH
POPR (MEADOW)	Kentucky bluegrass (meadow)	PCT	MD3111	Warm Low SM RH	Low SM RH
POSA3-DAUN	Sandberg's bluegrass-onespike oatgrass	PA	GB9111	Hot Dry UH	Dry UH
POTR/ALIN-COST	quaking aspen/mountain alder-redosier dogwood	PCT	HQS222	Warm Moderate SM RF	Moderate SM RF
POTR/ALIN-SYAL	quaking aspen/mountain alder-common snowberry	PCT	HQS223	Warm Moderate SM RF	Moderate SM RF

PVT CODE	PVT COMMON NAME	STATUS	ECOCCLASS	PAG	PVG
POTR/CAAQ	quaking aspen/aquatic sedge	PCT	HQM212	Warm High SM RF	High SM RF
POTR/CACA	quaking aspen/bluejoint reedgrass	PCT	HQM123	Warm Moderate SM RF	Moderate SM RF
POTR/CALA3	quaking aspen/woolly sedge	PA	HQM211	Warm Moderate SM RF	Moderate SM RF
POTR/MESIC FORB	quaking aspen/mesic forb	PCT	HQM511	Warm Moderate SM RF	Moderate SM RF
POTR/POPR	quaking aspen/Kentucky bluegrass	PCT	HQM122	Hot Low SM RF	Low SM RF
POTR/SYAL	quaking aspen/common snowberry	PCT	HQS221	Hot Moderate SM RF	Moderate SM RF
POTR2/ACGL	black cottonwood/Rocky Mountain maple	PCT	HCS114	Warm Moderate SM RF	Moderate SM RF
POTR2/ALIN-COST	black cottonwood/mountain alder-redosier dogwood	PA	HCS113	Warm Moderate SM RF	Moderate SM RF
POTR2/SALA2	black cottonwood/Pacific willow	PA	HCS112	Hot Moderate SM RF	Moderate SM RF
POTR2/SYAL	black cottonwood/common snowberry	PCT	HCS311	Hot Moderate SM RF	Moderate SM RF
PSME/ACGL-PHMA	Douglas-fir/Rocky Mountain maple-mallow ninebark	PA	CDS722	Warm Moist UF	Moist UF
PSME/ACGL-PHMA (FLOODPLAIN)	Douglas-fir/Rocky Mountain maple-mallow ninebark (floodplain)	PA	CDS724	Warm Moderate SM RF	Moderate SM RF
PSME/CAGE	Douglas-fir/elk sedge	PA	CDG111	Warm Dry UF	Dry UF
PSME/CARU	Douglas-fir/pinegrass	PA	CDG121	Warm Dry UF	Dry UF
PSME/CELE/CAGE	Douglas-fir/mountain mahogany/elk sedge	PCT	CDS	Warm Dry UF	Dry UF
PSME/HODI	Douglas-fir/oceanspray	PA	CDS611	Warm Moist UF	Moist UF
PSME/PHMA	Douglas-fir/ninebark	PA	CDS711	Warm Dry UF	Dry UF
PSME/SPBE	Douglas-fir/birchleaf spiraea	PA	CDS634	Warm Dry UF	Dry UF
PSME/SYAL	Douglas-fir/common snowberry	PA	CDS622	Warm Dry UF	Dry UF
PSME/SYAL (FLOODPLAIN)	Douglas-fir/common snowberry (floodplain)	PA	CDS628	Warm Low SM RF	Low SM RF
PSME/SYOR	Douglas-fir/mountain snowberry	PA	CDS625	Warm Dry UF	Dry UF
PSME/TRCA3	Douglas-fir/false bugbane	PCT	CDF313	Warm Moderate SM RF	Moderate SM RF
PSME/VAME	Douglas-fir/big huckleberry	PA	CDS812	Warm Dry UF	Dry UF
PUPA	weak alkaligrass	PA	MM2926	Warm High SM RH	High SM RH
PUTR/AGSP	bitterbrush/bluebunch wheatgrass	PA	SD3112	Hot Moist US	Moist US
PUTR/FEID-AGSP	bitterbrush/Idaho fescue-bluebunch wheatgrass	PA	SD3111	Warm Moist US	Moist US
RHAL2/MESIC FORB	alderleaved buckthorn/mesic forb	PCT	SW5117	Warm Moderate SM RS	Moderate SM RS
RHGL/AGSP	smooth sumac/bluebunch wheatgrass	PA	SD6121	Hot Dry US	Dry US
RIBES/CILA2	currants/drooping woodreed	PCT	SW5111	Warm High SM RS	High SM RS
RIBES/GLEL	currants/tall mannagrass	PCT	SW5116	Warm High SM RS	High SM RS
RIBES/MESIC FORB	currants/mesic forb	PCT	SW5115	Warm Moderate SM RS	Moderate SM RS
SAAR4	brook saxifrage	PCT	FW6113	Warm High SM RH	High SM RH
SACO2/CAPR5	undergreen willow/clustered field sedge	PC	SW1128	Cold High SM RS	High SM RS
SACO2/CASC5	undergreen willow/Holm's sedge	PA	SW1121	Cold High SM RS	High SM RS
SACO2/CAUT	undergreen willow/bladder sedge	PCT	SW1127	Cold High SM RS	High SM RS
SAEA-SATW/CAAQ	Eastwood willow-Tweedy willow/aquatic sedge	PC	SW1129	Warm High SM RS	High SM RS
SAEX	coyote willow	PA	SW1117	Hot Moderate SM RS	Moderate SM RS
SALIX/CAAQ	willow/aquatic sedge	PA	SW1114	Warm High SM RS	High SM RS
SALIX/CACA	willow/bluejoint reedgrass	PC	SW1124	Warm Moderate SM RS	Moderate SM RS
SALIX/CALA3	willow/woolly sedge	PA	SW1112	Warm Moderate SM RS	Moderate SM RS

<b>PVT CODE</b>	<b>PVT COMMON NAME</b>	<b>STATUS</b>	<b>ECOCLASS</b>	<b>PAG</b>	<b>PVG</b>
SALIX/CAUT	willow/bladder sedge	PA	SW1123	Warm High SM RS	High SM RS
SALIX/MESIC FORB	willow/mesic forb	PCT	SW1125	Warm Moderate SM RS	Moderate SM RS
SALIX/POPR	willow/Kentucky bluegrass	PCT	SW1111	Warm Low SM RS	Low SM RS
SARI	rigid willow	PCT	SW1126	Hot Moderate SM RS	Moderate SM RS
SASC/ELGL	Scouler willow/blue wildrye	PC	SW1130	Cool Moist US	Cold US
SCMI	smallfruit bulrush	PA	MM2924	Warm High SM RH	High SM RH
SETR	arrowleaf groundsel	PA	FW4211	Warm High SM RH	High SM RH
SPCR (RIVER TERRACE)	sand dropseed (river terrace)	PA	GB1211	Hot Dry UH	Dry UH
STOC	western needlegrass	PCT	GS10	Cool Moist UH	Cold UH
SYAL/FEID-AGSP-LUSE	common snowberry/fescue-wheatgrass-silky lupine	PCT	GB5121	Warm Moist US	Moist US
SYAL/FEID-KOCR	common snowberry/Idaho fescue-prairie junegrass	PCT	GB5919	Warm Moist US	Moist US
SYAL-ROSA	common snowberry-rose	PCT	SM3111	Warm Moist US	Moist US
SYOR	mountain snowberry	PCT	SM32	Warm Moist US	Moist US
TSME/VAME	mountain hemlock/big huckleberry	PA	CMS231	Cold Dry UF	Cold UF
TSME/VASC	mountain hemlock/grouse huckleberry	PA	CMS131	Cold Dry UF	Cold UF
TYLA	common cattail	PCT	MT8121	Hot High SM RH	High SM RH
VEAM	American speedwell	PA	FW6112	Warm High SM RH	High SM RH
VERAT	false hellebore	PC	FW5121	Warm Moderate SM RH	Moderate SM RH

<sup>1</sup> This appendix is organized alphabetically by PVT code. Column descriptions are:

PVT CODE provides an alphanumeric code for 296 potential vegetation types described for Blue Mountains section.

PVT COMMON NAME provides a common name for each potential vegetation type.

STATUS provides classification status for each potential vegetation type: PA is Plant Association; PCT is Plant Community Type; PC is Plant Community.

ECOCLASS codes are used to record potential vegetation type determinations.

PAG (Plant Association Group) and PVG (Potential Vegetation Group) are two levels of a mid-scale potential vegetation hierarchy; PAG and PVG codes use the following abbreviations: SM is Soil Moisture, UF is Upland Forest physiognomic class, UW is Upland Woodland physiognomic class, US is Upland Shrubland physiognomic class, UH is Upland Herbland physiognomic class, RF is Riparian Forest physiognomic class, RS is Riparian Shrubland physiognomic class, and RH is Riparian Herbland physiognomic class.

## APPENDIX 2: SILVICULTURE WHITE PAPERS

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White papers are internal reports, and they are produced with a consistent formatting and numbering scheme – all papers dealing with Silviculture, for example, are placed in a silviculture series (Silv) and numbered sequentially. Generally, white papers receive only limited review and, in some instances pertaining to highly technical or narrowly focused topics, the papers may receive no technical peer review at all. For papers that receive no review, the viewpoints and perspectives expressed in the paper are those of the author only, and do not necessarily represent agency positions of the Umatilla National Forest or the USDA Forest Service.

Large or important papers, such as two papers discussing active management considerations for dry and moist forests (white papers Silv-4 and Silv-7, respectively), receive extensive review comparable to what would occur for a research station general technical report (but they don't receive blind peer review, a process often used for journal articles).

White papers are designed to address a variety of objectives:

- (1) They guide how a methodology, model, or procedure is used by practitioners on the Umatilla National Forest (to ensure consistency from one unit, or project, to another).
- (2) Papers are often prepared to address ongoing and recurring needs; some papers have existed for more than 20 years and still receive high use, indicating that the need (or issue) has long standing – an example is white paper #1 describing the Forest's big-tree program, which has operated continuously for 25 years.
- (3) Papers are sometimes prepared to address emerging or controversial issues, such as management of moist forests, elk thermal cover, or aspen forest in the Blue Mountains. These papers help establish a foundation of relevant literature, concepts, and principles that continuously evolve as an issue matures, and hence they may experience many iterations through time. [But also note that some papers have not changed since their initial development, in which case they reflect historical concepts or procedures.]
- (4) Papers synthesize science viewed as particularly relevant to geographical and management contexts for the Umatilla National Forest. This is considered to be the Forest's self-selected 'best available science' (BAS), realizing that non-agency commenters would generally have a different conception of what constitutes BAS – like beauty, BAS is in the eye of the beholder.
- (5) The objective of some papers is to locate and summarize the science germane to a particular topic or issue, including obscure sources such as master's theses or Ph.D. dissertations. In other instances, a paper may be designed to wade through an overwhelming amount of published science (dry-forest management), and then synthesize sources viewed as being most relevant to a local context.
- (6) White papers function as a citable literature source for methodologies, models, and procedures used during environmental analysis – by citing a white paper,



specialist reports can include less verbiage describing analytical databases, techniques, and so forth, some of which change little (if at all) from one planning effort to another.

- (7) White papers are often used to describe how a map, database, or other product was developed. In this situation, the white paper functions as a ‘user’s guide’ for the new product. Examples include papers dealing with historical products: (a) historical fire extents for the Tucannon watershed (WP Silv-21); (b) an 1880s map developed from General Land Office survey notes (WP Silv-41); and (c) a description of historical mapping sources (24 separate items) available from the Forest’s history website (WP Silv-23).

These papers are available from the Forest’s website: [Silviculture White Papers](#)

**Paper # Title**

- |    |  |
|----|--|
| 1  | Big tree program   |
| 2  | Description of composite vegetation database   |
| 3  | Range of variation recommendations for dry, moist, and cold forests  |
| 4  | Active management of Blue Mountains dry forests: Silvicultural considerations  |
| 5  | Site productivity estimates for upland forest plant associations of Blue and Ochoco Mountains                                  |
| 6  | Blue Mountains fire regimes  |
| 7  | Active management of Blue Mountains moist forests: Silvicultural considerations  |
| 8  | Keys for identifying forest series and plant associations of Blue and Ochoco Mountains   |
| 9  | Is elk thermal cover ecologically sustainable?   |
| 10 | A stage is a stage is a stage...or is it? Successional stages, structural stages, seral stages                                 |
| 11 | Blue Mountains vegetation chronology   |
| 12 | Calculated values of basal area and board-foot timber volume for existing (known) values of canopy cover                       |
| 13 | Created opening, minimum stocking, and reforestation standards from Umatilla National Forest Land and Resource Management Plan |
| 14 | Description of EVG-PI database   |
| 15 | Determining green-tree replacements for snags: A process paper   |
| 16 | Douglas-fir tussock moth: A briefing paper   |
| 17 | Fact sheet: Forest Service trust funds   |
| 18 | Fire regime condition class queries  |
| 19 | Forest health notes for an Interior Columbia Basin Ecosystem Management Project field trip on July 30, 1998 (handout)          |
| 20 | Height-diameter equations for tree species of Blue and Wallowa Mountains   |
| 21 | Historical fires in headwaters portion of Tucannon River watershed   |

<b>Paper #</b>	<b>Title</b>
22	Range of variation recommendations for insect and disease susceptibility
23	Historical vegetation mapping
24	How to measure a big tree
25	Important Blue Mountains insects and diseases
26	Is this stand overstocked? An environmental education activity
27	Mechanized timber harvest: Some ecosystem management considerations
28	Common plants of south-central Blue Mountains (Malheur National Forest)
29	Potential natural vegetation of Umatilla National Forest
30	Potential vegetation mapping chronology
31	Probability of tree mortality as related to fire-caused crown scorch
32	Review of "Integrated scientific assessment for ecosystem management in the interior Columbia basin, and portions of the Klamath and Great basins" – Forest vegetation
33	Silviculture facts
34	Silvicultural activities: Description and terminology
35	Site potential tree height estimates for Pomeroy and Walla Walla Ranger Districts
36	Stand density protocol for mid-scale assessments
37	Stand density thresholds as related to crown-fire susceptibility
38	Umatilla National Forest Land and Resource Management Plan: Forestry direction
39	Updates of maximum stand density index and site index for Blue Mountains variant of Forest Vegetation Simulator
40	Competing vegetation analysis for southern portion of Tower Fire area
41	Using General Land Office survey notes to characterize historical vegetation conditions for Umatilla National Forest
42	Life history traits for common Blue Mountains conifer trees
43	Timber volume reductions associated with green-tree snag replacements
44	Density management field exercise
45	Climate change and carbon sequestration: Vegetation management considerations
46	Knutson-Vandenberg (K-V) program
47	Active management of quaking aspen plant communities in northern Blue Mountains: Regeneration ecology and silvicultural considerations
48	Tower Fire...then and now. Using camera points to monitor postfire recovery
49	How to prepare a silvicultural prescription for uneven-aged management
50	Stand density conditions for Umatilla National Forest: A range of variation analysis
51	Restoration opportunities for upland forest environments of Umatilla National Forest

**Paper # Title**

- |    |   |
|----|---|
| 52 | New perspectives in riparian management: Why might we want to consider active management for certain portions of riparian habitat conservation areas? |
| 53 | Eastside Screens chronology   |
| 54 | Using mathematics in forestry: An environmental education activity  |
| 55 | Silviculture certification: Tips, tools, and trip-ups   |
| 56 | Vegetation polygon mapping and classification standards: Malheur, Umatilla, and Wallowa-Whitman National Forests                                      |
| 57 | State of vegetation databases for Malheur, Umatilla, and Wallowa-Whitman National Forests   |
| 58 | Seral status for tree species of Blue and Ochoco Mountains  |

**REVISION HISTORY**

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**February 2012:** formatting and editing changes were made; susceptibility ranges were adjusted for all three potential vegetation groups; an appendix was added describing a white paper system, including a list of available white papers.